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covering the position of the closed eye. The various cases tested by the method described led to the conclusion 'that the closed eye follows the open eye to a certain extent, and to a certain extent obeys its own tendencies of relaxation.' These facts, together with the changes in accommodation pointed out, may be made use of to explain some of the differences between ordinary vision and vision with a single eye, as, for example, the fact that an object seen with one eye looks farther away and smaller.

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SCIENTIFIC LITERATURE.

Lehrbuch der vergleichenden mikroskopischen Anatomie der Wirbelthiere. Von Dr. med ALBERT OPPEL. Zweiter Theil. Schlund und Darm. Jena, Gustav Fischer. 1897. Price, 20 Marks.

The second part of Professor Oppel's storehouse of facts is a valuable addition to our literature on microscopic anatomy and is to be classed with books of the calibre of Minot's Embryology. It is a handsome volume of 682 pages, 343 text figures and four lithographic plates. In addition to an exhaustive review of all the literature on the œsophagus and intestines (the stomach having been considered in the first volume), it gives a list of the scientific names of the animals, a classification of the vertebrates, a list of all the references, an index of the authors and a complete index of its contents. All in all, it is a hand book of the microscopic anatomy of the œsophagus and intestines.

In general he states that the intestinal canal is always composed of the following layers :

1. A mucosa covered with a layer of epithelium. This, in turn, is divided into the true mucosa and the submucosa, between which there is usually a muscularis mucosæ, and less frequently an additional layer lying upon the muscularis mucosæ, the stratum compactum.
2. A muscularis, usually composed of an inner circular and an outer longitudinal layer.
3. An adventitia, often poorly developed, and towards the body cavity (cœlom) covered with a layer of flat endothelium, the serosa.

After giving the above very general classification of the layers in order to adapt them to all the classes of vertebrates, Oppel states that the following are the important layers :

1. Epithelium.
2. Tunica propria of the mucosa.
3. Stratum compactum.
4. Muscularis mucosæ, circular and longitudinal layers.
5. Submucosa.
6. Circular muscle, }
7. Longitudinal muscle, } or muscle layers.
8. Subserosa.
9. Serosa.

These layers in turn are bound together by glands growing in from the epithelium, blood-vessels, lymphatics and nerves. In general, under the above headings he discusses the whole subject, each time giving the variations corresponding to the order of the families of the vertebrates. Throughout the work most extensive use is made of the literature and nearly all of the figures are borrowed, but they have been carefully redrawn.

After the chapter on the œsophagus the epithelium of the intestine is taken up (pp. 160-232), giving the history of its discovery, and its appearance in animals from amphioxus to man. Then are discussed such subjects as the striated border, cell membrane, intercellular bridges, relation of the epithelial cells to the connective tissues, basement membrane, regeneration and goblet cells. Under intercellular bridges it is interesting to note that sufficient data have been collected to state that the bridges do exist, and it is prophesied that future investigation will fully corroborate this view.

The regeneration of the epithelial cell is discussed under the heading 'Bizzozero's theory.' Bizzozero's observation is that the epithelial cells at the bases of Lieberkühn's crypts are constantly dividing to re-establish the cells of the villi. In order to do this the cells must be shifting constantly from the bases of the crypts towards the tips of the villi. This, according to Oppel, is very unlike regeneration in other organs, and, if true, will lead to the conclusion that the crypts are not glands, but only growing points for the cells covering the villi. It appears to us unfortunate that Oppel does

not see his way clear to accept Bizzozero's theory of the regeneration of the cells covering the villi, as it is the only plausible explanation of it. It does not seem to us that a shifting of the cells from the crypts to the villi necessarily proves that the crypts are not glands, for it is by no means shown that the function of the cells covering the villi is only to absorb. It may also be to secrete. The large number of goblet cells would appear to indicate this. Moreover, similar instances corroborative of Bizzozero's theory are not wanting, as, for instance, in the central nervous system and in the epidermis, and until it is proved to be incorrect it seems to us that it is well to retain the theory.

The mucosa proper is the most complex portion of the intestine, as the folds, villi, and villi upon folds, are only modifications of a simpler membrane. In the mucosa we have all of the characteristics of a lymph gland, extending from the muscularis mucosæ into the folds and villi. Between the bases of the villi and the muscularis mucosæ, the crypts, when present, are lodged. The connective-tissue frame-work of the mucosa has been shown to be composed of fibers, neither white fibrous nor yellow elastic, which are constantly anastomosing to form a reticulum identical with that of lymph nodules. Siegfried has recently shown that they are composed of a body rich in sulphur and phosphorus, which he has called 'reticulin.' Oppel gives a good discussion of this tissue and its importance. Below the crypts the lymphatic tissue is arranged in a layer known as the stratum granulosum.

Between the stratum granulosum and the muscularis mucosæ there is an additional hyaline membrane. This layer had been observed a number of times in the stomach and intestine of various animals and was isolated and discussed by Mall as the stratum fibrosum. Oppel objects to this name, as there had been a difference of opinion regarding its constitution, and substitutes for it the name stratum compactum. Since the appearance of Oppel's book, however, Spalteholz has shown conclusively that this layer is really composed of white fibrous tissue, and, therefore, the name stratum fibrosum is still appropriate. It is to be regretted that Spalteholz's paper appeared

too late to be used by Oppel, for the introduction of new terms has a tendency to add confusion to the subject.

The description of Brunner's glands, the lymphatic vessels and nodules, the blood-vessels and nerves is extensive and complete, but it is of such a nature that it cannot be given in a brief review.

The above shows the extent and some of the features of the book. It is a mine of facts arranged in such a manner that anything in it can be easily found. If the work were more critical it would be of much greater value. But as it stands it is a great addition to our literature and will be welcomed by all students of anatomy. FRANKLIN P. MALL.

Whittaker's Mechanical Engineer's Pocket-book.

By PHILIP R. BJÖRLING. London, Whittaker & Co.; New York, The Macmillan Co. 1898. 32mo. Pp. 377. Illustrations. Price, \$1.75.

This is a 'pocket-book' of the now standard form and page, and including the usual compilation of tables and data for use in the design of machinery and works of engineering. It is neatly put up and well bound, with good paper and clear type of larger size than the microscopic print often seen in such books, vexing the eye and trying the patience of the reader. The first section of the book is devoted to hydraulics and water-wheels, and is exceptionally extensive for a compilation of this size. The section on steam-engines includes modern forms, and gives the proportions of the later constructions. The empirical but standard rules of construction are given, as customarily employed by British designers, and good tables of hyperbolic logarithms and of mean pressures are added. Proportions of details of machine-construction are given very fully, no space being given up to references. The usual and always necessary numerical tables conclude the work.

R. H. T.

The Entropy-Temperature Analysis of Steam-Engine Efficiencies. Prepared by SIDNEY A. REEVE, M.E. New York, Progressive Age Co. 1897. 8vo. Pp. 20, with large folded diagram.

Since the publication of the now famous